

## SEQUENCE LISTING



#9

<110> Hasse, Detlef  
Panaccio, Michael  
Sinistaj, Meri

<120> LAWSONIA DERIVED GENE AND RELATED OMPH  
POLYPEPTIDES, PEPTIDES, AND PROTEINS AND THEIR USES

<130> DAVI149.001APC

<140> US 10/018,290

<141> 2001-11-13

<150> PCT/AU00/00438

<151> 2000-05-11

<150> US 60/133,986

<151> 1999-05-13

<160> 13

<170> FastSEQ for Windows Version 4.0

<210> 1

<211> 186

<212> PRT

<213> Lawsonia intracellularis

<400> 1

Met Lys Val Lys Thr Leu Ser Met Ala Ile Leu Ala Cys Leu Leu Val  
1 5 10 15  
Ala Asn Ser Ala Phe Ser Ala Asp Phe Pro Ile Gly Val Phe Asn Ser  
20 25 30  
Gln Ser Ile Ala Met Glu Ser Glu Ala Ala Lys Ala Ala Gln Lys Lys  
35 40 45  
Leu Gln Ser Glu Phe Gly Asn Glu Lys Thr Gln Leu Glu Lys Gln Ala  
50 55 60  
Lys Asp Leu Gln Thr Lys Ala Asp Asp Leu Gln Ala Lys Ser Ala Ala  
65 70 75 80  
Met Ser Asn Gln Ala Arg Glu Asp Lys Gln Arg Glu Phe Leu Glu Leu  
85 90 95  
Arg Arg Asn Phe Glu Glu Lys Ser Arg Asp Phe Ala Ile Arg Val Glu  
100 105 110  
Gln Ala Glu Asn Thr Leu Arg Gln Tyr Leu Ala Glu Gln Ile Tyr Leu  
115 120 125  
Ala Ala Glu Thr Ile Ala Lys Lys Lys Gly Leu Lys Leu Val Leu Asp  
130 135 140  
Ser Ala Ser Gly Ser Val Met Tyr Leu Glu Lys Asn Leu Asp Ile Thr  
145 150 155 160  
Lys Glu Ile Leu Glu Ala Ile Asn Ala Ala Trp Lys Lys Gly Gly Ser  
165 170 175  
Lys Leu Pro Glu Met Ala Asn Arg Lys Lys

<210> 2  
 <211> 561  
 <212> DNA  
 <213> *Lawsonia intracellularis*

<220>  
 <221> CDS  
 <222> (1)...(561)

<400> 2  
 atg aaa gta aaa act ctt tcc atg gct att tta gct tgt tta tta gta 48  
 Met Lys Val Lys Thr Leu Ser Met Ala Ile Leu Ala Cys Leu Leu Val  
 1 5 10 15  
 gct aac agt gca ttt tcg gct gac ttc cct att ggt gtc ttt aat tct 96  
 Ala Asn Ser Ala Phe Ser Ala Asp Phe Pro Ile Gly Val Phe Asn Ser  
 20 25 30  
 caa tcc att gcc atg gag agt gaa gca gct aag gcc gct caa aaa aaa 144  
 Gln Ser Ile Ala Met Glu Ser Glu Ala Ala Lys Ala Ala Gln Lys Lys  
 35 40 45  
 tta caa tca gaa ttt ggt aat gaa aaa aca caa ctt gaa aaa caa gca 192  
 Leu Gln Ser Glu Phe Gly Asn Glu Lys Thr Gln Leu Glu Lys Gln Ala  
 50 55 60  
 aaa gat ttg caa aca aaa gct gat gat tta caa gct aag tca gca gct 240  
 Lys Asp Leu Gln Thr Lys Ala Asp Asp Leu Gln Ala Lys Ser Ala Ala  
 65 70 75 80  
 atg tct aac caa gca cgt gaa gat aaa caa aga gaa ttt ctt gaa ctt 288  
 Met Ser Asn Gln Ala Arg Glu Asp Lys Gln Arg Glu Phe Leu Glu Leu  
 85 90 95  
 cgt cgt aat ttc gaa gaa aaa tct cgt gac ttt gca ata cgt gtc gaa 336  
 Arg Arg Asn Phe Glu Glu Lys Ser Arg Asp Phe Ala Ile Arg Val Glu  
 100 105 110  
 caa gct gaa aac aca tta cgt caa tat cta gct gaa caa atc tat ctt 384  
 Gln Ala Glu Asn Thr Leu Arg Gln Tyr Leu Ala Glu Gln Ile Tyr Leu  
 115 120 125  
 gct gct gaa act ata gca aaa aag aaa ggg tta aaa ctt gtt ctt gat 432  
 Ala Ala Glu Thr Ile Ala Lys Lys Lys Gly Leu Lys Leu Val Leu Asp  
 130 135 140  
 agt gct agt gga agt gta atg tac ctt gaa aaa aat cta gat att aca 480  
 Ser Ala Ser Gly Ser Val Met Tyr Leu Glu Lys Asn Leu Asp Ile Thr  
 145 150 155 160  
 aaa gaa att ctt gaa gcc ata aat gct gca tgg aaa aaa ggt gga agt 528  
 Lys Glu Ile Leu Glu Ala Ile Asn Ala Ala Trp Lys Lys Gly Gly Ser

165

170

175

aaa ctt cca gag atg gca aac cgg aaa aaa taa  
 Lys Leu Pro Glu Met Ala Asn Arg Lys Lys \*  
 180 185

561

&lt;210&gt; 3

&lt;211&gt; 23

&lt;212&gt; DNA

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; oligonucleotide primer RA176 forward

&lt;400&gt; 3

tttattcatt cagaaggagc ttc

23

&lt;210&gt; 4

&lt;211&gt; 21

&lt;212&gt; DNA

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; oligonucleotide primer RA177 reverse

&lt;400&gt; 4

aagtttagca atttctgaaa g

21

&lt;210&gt; 5

&lt;211&gt; 143

&lt;212&gt; PRT

&lt;213&gt; Yersinia pseudotuberculosis

&lt;400&gt; 5

Ser Ser Ile Phe Gln Gln Leu Pro Ala Arg Glu Ala Val Ala Ala Gly  
 1 5 10 15  
 Lys Lys Gln Leu Glu Asn Glu Phe Lys Gly Arg Ala Thr Glu Leu Gln  
 20 25 30  
 Gly Ile Ala Ile Val Asn Val Met Glu Arg Asp Leu Gln Thr Lys Met  
 35 40 45  
 Gln Lys Leu Gln Arg Asp Gly Ser Thr Met Lys Ala Ser Asp Arg Thr  
 50 55 60  
 Lys Ile Leu Ser Arg Ile Gln Asp Ala Val Lys Ser Val Ala Thr Leu  
 65 70 75 80  
 Glu Asn Glu Val Met Lys Gln Arg Glu Thr Lys Gly Gly Tyr Asp Val  
 85 90 95  
 Val Ile Asp Ala Asn Ala Val Ala Tyr Ala Asp Ser Ser Phe Ser Thr  
 100 105 110  
 Lys Ala Gln Ala Phe Glu Gln Asp Asn Arg Arg Arg Gln Ala Glu Glu  
 115 120 125  
 Arg Asn Lys Lys Asp Ile Thr Ala Asp Val Leu Lys Gln Val Lys  
 130 135 140

<210> 6  
 <211> 164  
 <212> PRT  
 <213> *Yersinia enterocolitica*

<400> 6  
 Met Lys Lys Ser Ser Ile Phe Gln Gln Leu Pro Ala Arg Glu Thr Val  
 1 5 10 15  
 Ala Trp Leu Cys Ala Ala Ser Leu Gly Leu Ala Leu Ala Ala Ser Ala  
 20 25 30  
 Arg Val Gln Ala Ala Lys Ile Lys Gln Leu Glu Asn Glu Phe Lys Gly  
 35 40 45  
 Arg Ala Thr Glu Leu Gln Gly Ala Ile Val Asn Val Met Glu Arg Asp  
 50 55 60  
 Leu Gln Thr Lys Met Gln Lys Leu Gln Arg Asp Gly Ser Thr Met Lys  
 65 70 75 80  
 Ala Ser Asp Arg Thr Lys Ile Leu Ser Arg Ile Gln Asp Ala Val Lys  
 85 90 95  
 Ser Val Ala Ser Leu Glu Asn Asp Val Met Lys Gln Arg Glu Thr Lys  
 100 105 110  
 Gly Gly Tyr Asp Val Val Ile Asp Ala Asn Ala Val Ala Tyr Ala Asp  
 115 120 125  
 Pro Ser Phe Ser Thr Lys Ala Gln Ala Phe Glu Gln Asp Asn Arg Arg  
 130 135 140  
 Arg Gln Met Glu Glu Arg Asn Lys Lys Asp Ile Thr Ala Asp Val Leu  
 145 150 155 160  
 Lys Gln Val Lys

<210> 7  
 <211> 197  
 <212> PRT  
 <213> *Haemophilus influenzae*

<400> 7  
 Met Lys Asn Ile Gly Tyr Ile Phe Gln His His Pro Asp Arg Gln Ala  
 1 5 10 15  
 Val Ala Ala Lys Val Thr Ala Leu Ala Leu Gly Ile Ala Leu Ala Ser  
 20 25 30  
 Gly Tyr Ala Ser Ala Glu Glu Lys Asp Lys Leu Asp Ala Glu Phe Lys  
 35 40 45  
 Pro Val Ala Glu Lys Leu Ala Ala Ser Lys Ile Ala Phe Ile Asn Ala  
 50 55 60  
 Lys Glu Val Asp Asp Lys Ile Ala Ala Ala Arg Lys Lys Val Glu Ala  
 65 70 75 80  
 Lys Val Ala Ala Leu Glu Lys Asp Ala Pro Arg Leu Arg Gln Ala Asp  
 85 90 95  
 Ile Gln Lys Leu Leu Asp Ser Ile Gln Thr Ala Thr Asn Asn Leu Ala  
 100 105 110  
 Lys Arg Gln Gln Glu Ile Asn Lys Leu Gly Ala Ala Glu Asp Ala Glu  
 115 120 125  
 Leu Gln Lys Leu Met Gln Glu Ala Lys Gly Tyr Thr Tyr Val Leu Asp  
 130 135 140  
 Ala Asn Ser Ile Val Phe Ala Val Glu Gly Leu Arg Lys Leu Gln Val

145		150		155		160									
Glu	Ala	Gln	Ser	Lys	Leu	Ser	Arg	Lys	Lys	Ala	Glu	Leu	Glu	Lys	Met
		165		170		175									
Lys	Asp	Ile	Thr	Glu	Glu	Val	Leu	Lys	Ser	Ile	Pro	Ala	Ser	Glu	Lys
		180		185		190									
Ala	Gln	Glu	Lys	Lys											
	195														

<210> 8  
 <211> 162  
 <212> PRT  
 <213> Aquifex aeolicus

<400> 8															
Met	Glu	Gly	Asn	Lys	Val	Ile	Arg	Glu	Ser	Lys	Phe	Ile	Ala	Lys	Ala
1				5					10					15	
Gln	Ile	Met	Lys	Lys	Phe	Phe	Ala	Leu	Met	Thr	Leu	Ile	Ala	Gly	Ile
			20					25					30		
Ser	Phe	Ser	Leu	Asp	Thr	Glu	Leu	Arg	Lys	Glu	Leu	Glu	Lys	Tyr	Gln
		35					40					45			
Lys	Leu	Ile	Gln	Glu	Phe	Ala	Cys	Val	Asp	Thr	Lys	Gln	Lys	Lys	Leu
	50					55					60				
Glu	Ala	Leu	Lys	Lys	Ser	Leu	Glu	Ser	Lys	Ala	Leu	Ser	Glu	Lys	Ala
65					70					75				80	
Lys	Glu	Lys	Val	Phe	Asp	Lys	Val	Ile	Lys	Ile	Val	Glu	Ser	Thr	Ala
				85					90					95	
Lys	Lys	Ala	Lys	Glu	Ile	Glu	Gln	Leu	Glu	Asp	Glu	Lys	Lys	Lys	Ile
			100					105					110		
Lys	Ala	Val	Phe	Asp	Cys	Asn	Ser	Met	Leu	Tyr	Trp	Asp	Lys	Lys	Leu
		115				120						125			
Arg	Lys	Leu	Gln	Val	Glu	Ala	Gln	Ser	Lys	Leu	Ser	Arg	Lys	Lys	Ala
	130				135					140					
Glu	Leu	Glu	Lys	Met	Ile	Asp	Ile	Thr	Asn	Glu	Val	Leu	Lys	Glu	Leu
145				150					155					160	
Asp	Lys														

<210> 9  
 <211> 161  
 <212> PRT  
 <213> Escherichia coli

<400> 9															
Met	Lys	Lys	Gly	Ser	Leu	Phe	Gln	Gln	Val	Ala	Gln	Lys	Thr	Gly	Val
1				5					10					15	
Ser	Trp	Leu	Leu	Ala	Ala	Gly	Leu	Gly	Leu	Ala	Leu	Ala	Thr	Ser	Ala
		20						25					30		
Gln	Ala	Ala	Asp	Lys	Ile	Asn	Thr	Leu	Glu	Asn	Glu	Phe	Lys	Gly	Arg
		35				40						45			
Ala	Ser	Glu	Leu	Gln	Arg	Ala	Ile	Val	Asn	Met	Met	Glu	Thr	Asp	Leu
	50					55					60				
Gln	Ala	Lys	Met	Lys	Lys	Leu	Gln	Ser	Met	Lys	Ala	Gly	Ser	Asp	Arg
65					70					75				80	

Thr	Lys	Leu	Val	Thr	Arg	Ile	Gln	Thr	Ala	Val	Lys	Ser	Val	Ala	Asn
				85					90					95	
Leu	Glu	Lys	Asp	Val	Met	Ala	Gln	Arg	Gln	Thr	Ser	Gln	Asp	Ile	Asp
			100					105					110		
Leu	Val	Val	Asp	Ala	Asn	Ala	Val	Ala	Tyr	Asn	Ser	Ser	Asp	Val	Phe
		115					120					125			
Ala	Gln	Lys	Ala	Gln	Ala	Phe	Glu	Gln	Asp	Arg	Ala	Arg	Arg	Ser	Asn
	130					135					140				
Glu	Glu	Arg	Gly	Lys	Lys	Asp	Ile	Thr	Ala	Asp	Val	Leu	Lys	Gln	Val
145					150					155					160
Lys															

<210> 10  
 <211> 161  
 <212> PRT  
 <213> Streptococcus typhi

<400> 10															
Met	Lys	Lys	Gly	Asn	Leu	Phe	Gln	Gln	Val	Ala	Gln	Lys	Thr	Gly	Val
1				5					10					15	
Ser	Trp	Leu	Leu	Ala	Ala	Gly	Leu	Gly	Leu	Ala	Met	Val	Thr	Ser	Ala
		20						25					30		
Gln	Ala	Ala	Asp	Lys	Ile	Asn	Thr	Leu	Glu	Asn	Glu	Phe	Lys	Gly	Arg
		35					40					45			
Ala	Ala	Glu	Leu	Gln	Lys	Ala	Ile	Val	Asn	Met	Met	Glu	Thr	Asp	Leu
	50					55					60				
Gln	Ser	Lys	Met	Gln	Arg	Leu	Gln	Ser	Met	Lys	Ala	Gly	Ser	Asp	Arg
65					70					75				80	
Thr	Lys	Leu	Val	Thr	Arg	Ile	Gln	Thr	Ala	Val	Lys	Lys	Val	Ala	Asn
				85					90					95	
Leu	Glu	Lys	Asp	Val	Met	Ser	Gln	Arg	Gln	Thr	Asp	Gln	Ser	Ile	Asp
			100					105				110			
Leu	Val	Val	Asp	Ala	Asn	Thr	Val	Ala	Tyr	Asn	Ser	Ser	Asp	Val	Phe
		115					120					125			
Ala	Gln	Lys	Ala	Gln	Ala	Phe	Glu	Lys	Asp	Arg	Ala	Arg	Arg	Ser	Asn
	130					135					140				
Glu	Glu	Arg	Asn	Lys	Lys	Asp	Ile	Thr	Ala	Asp	Val	Leu	Lys	Gln	Val
145					150					155					160
Lys															

<210> 11  
 <211> 177  
 <212> PRT  
 <213> Chlamidia trachomatis

<400> 11															
Met	Lys	Lys	Phe	Arg	Arg	Cys	Leu	Glu	Glu	Ser	Ala	Leu	Gly	Lys	Lys
1				5					10					15	
Glu	Ser	Leu	Leu	Leu	Ser	Leu	Met	Ser	Leu	Ser	Ser	Leu	Pro	Thr	Phe
		20						25				30			
Ala	Ala	Asn	Ser	Thr	Gly	Thr	Ala	Glu	Phe	Glu	Lys	Met	Lys	Asn	Gln



Thr Ile Arg  
225

<210> 13  
<211> 199  
<212> PRT  
<213> Unknown

<220>  
<223> Sequence 1 from WO 97/01638

<221> VARIANT  
<222> (1)...(199)  
<223> Xaa = Any Amino Acid

<400> 13  
Met Lys Asn Ile Gly Tyr Ile Phe His His Pro Asp Arg Gln Ala Val  
1 5 10 15  
Ala Ala Lys Val Thr Ala Leu Ala Leu Gly Ile Ala Leu Ala Ser Gly  
20 25 30  
Tyr Ala Ser Ala Glu Glu Lys Asp Lys Leu Asp Ala Glu Phe Lys Pro  
35 40 45  
Val Ala Glu Lys Leu Ala Ala Ser Lys Ile Ala Phe Ile Asn Ala Lys  
50 55 60  
Glu Val Asp Asp Lys Ile Ala Ala Ala Arg Lys Lys Val Glu Ala Lys  
65 70 75 80  
Val Ala Ala Leu Glu Lys Asp Ala Pro Arg Leu Arg Gln Ala Asp Ile  
85 90 95  
Gln Lys Leu Leu Asp Ser Ile Gln Thr Ala Thr Asn Asn Leu Ala Arg  
100 105 110  
Arg Gln Glu Glu Ile Asn Lys Leu Gly Ala Ala Glu Asp Ala Glu Leu  
115 120 125  
Gln Lys Leu Met Gln Glu Ala Lys Gly Tyr Thr Tyr Val Leu Asp Ala  
130 135 140  
Asn Ser Val Val Phe Ala Val Glu Gly Gln Asp Lys Lys Val Gln Glu  
145 150 155 160  
Phe Gln Ala Gln Asn Glu Lys Arg Gln Ala Glu Glu Arg Gly Lys Lys  
165 170 175  
Asp Ile Thr Glu Glu Val Leu Lys Ser Ile Pro Ala Ser Glu Lys Ala  
180 185 190  
Gln Phe Lys Lys Xaa Xaa Val  
195